

New Research Proposal

**EVALUATION OF ADULT PACIFIC LAMPREY PASSAGE SUCCESS
AT MCNARY AND LOWER SNAKE RIVER DAMS**

Study Code: ADS-P-00-8

To

U.S. Army Corps of Engineers, District
Walla Walla, Washington

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EVALUATION OF ADULT PACIFIC LAMPREY PASSAGE SUCCESS AT McNARY AND LOWER SNAKE RIVER DAMS

Study Summary

A. Goal

The goal of this study is to evaluate passage of adult Pacific lamprey *Lampetra tridentata* at McNary and the four Lower Snake River dams and associated reservoirs. The study proposed here would collect baseline information on passage success and potential obstacles to migrating adult lamprey.

B. Objectives - 2005

1. Develop adult lamprey collection, tagging and release operations at McNary and Ice Harbor dams.
2. Develop HD PIT detector systems to monitor key locations in fishways at McNary Dam and four lower Snake River dams.
3. Monitor movements and behavior of adult lamprey migrants at McNary and four lower Snake River dams.

C. Methods

Trapping procedures, such as those currently used at Bonneville Dam, will be used at McNary Dam to collect adult Pacific lamprey for tagging and passage evaluations. Fish will be implanted with half duplex passive integrated transponder (HD PIT) tags, released downstream from the dam, and monitored using newly developed HD PIT detectors placed at strategic locations in the fishway at McNary and Ice Harbor dams. Using HD PIT systems will eliminate the probability that PIT-tagged lamprey will interfere with detections of adult anadromous salmonids at standard (ISO) fishway PIT detectors. Passage evaluations will be based on proportions of fish that successfully pass each segment of the fishway(s). A subsample of lamprey will be tagged with both an HD PIT and radio transmitter to test the effectiveness of HD PIT detectors and to detect lamprey at more locations in and around the fishways. Proportions of radio-tagged fish known to have passed HD PIT detectors will be used to correct passage efficiencies determined from HD PIT detections, if necessary.

D. Relevance

This project will address concerns raised by Tribal agencies, the U. S. Army Corps of Engineers (COE), and the Northwest Power Planning Council in section 7.5F of the 1994 Columbia River Basin Fish and Wildlife Program, related to effects of FCRPS Projects on passage of Pacific lamprey in the Columbia and Snake rivers. The loss of Pacific lamprey as a cultural resource has raised concerns among Columbia River tribes (Close et al. 2002). Improving lamprey passage at Columbia River hydropower dams was identified as the highest priority for lamprey recovery by the Columbia Basin Pacific Lamprey Technical

Workgroup. In addition, in 2002 the U.S. Fish and Wildlife Service received a petition to list Pacific lamprey as a federally-endangered or threatened species. Lamprey are currently not listed but interest and desire by multiple groups is increasing to improve the productivity of this endemic species within the Columbia River system.

Project Description

A. Background

Declining returns of pre-spawning adult Pacific lamprey *Lampetra tridentata* to the Columbia River highlight the need to document juvenile and adult passage at dams (Close et al. 1995; Jackson et al. 1996). Pacific lamprey are anadromous and must pass up to eight or nine dams and reservoirs, four each in the lower Columbia and Snake rivers and five in the mid Columbia River, to reach upstream spawning areas historically used by the species.

Studies evaluating lamprey passage and methods to improve passage at dams were initiated in 1997 at Bonneville Dam. We found that passage efficiency of lamprey approaching Bonneville Dam was less than 50% in all years (Moser et al. 2002). Passage efficiency for lamprey that approached The Dalles Dam was consistently higher than at Bonneville Dam, while passage efficiency at John Day Dam was usually lower than at Bonneville Dam. Of particular concern is poor performance of lamprey at fishway entrances, through collection channels/transition areas, and past vertical slot fishways at the top of the fishways at Bonneville Dam (Moser et al. 2002). From tests conducted in an experimental fishway channel we determined what conditions were and were not conducive to lamprey passage (Daigle et al. *In review*). Information from these studies were incorporated into fishway improvements and the ongoing development and testing of structures to collect and bypass adult lamprey at passage restrictions. Preliminary results on the utility of bypassing lamprey are promising and we believe these efforts, which to this point have been focused at Bonneville Dam, can be applied to upstream passage facilities.

Impeding passage of lamprey below dams may subject them to increased predation pressure and other sources of loss. Difficult passage conditions may also decrease recruitment to upstream populations. This project is being initiated to gain information on migration behavior of adult lamprey, and to determine what factors affect their passage at McNary Dam and the four lower Snake River dams. This proposal was developed in response to a preliminary request for proposals issued by the COE in June of 2004, and it addresses concerns raised by the COE and the Northwest Power Planning Council in section 7.5F of the 1994 Columbia River Basin Fish and Wildlife Program. Operational or structural changes at dams intended to improve lamprey passage success must also address RPA 119 of the 2000 NMFS Biological Opinion that "alterations to fish ladders and adult passage facilities to accommodate Pacific lamprey passage do not adversely affect salmonids passage timing and success". This proposal was developed via consultation with the COE, and in response to the high priority assigned to adult passage research in the Columbia and Snake rivers by the former Fish Research Needs and Priorities subcommittee of the Fish Passage Development and Evaluation Program, and the current Anadromous Fish Evaluation Program.

B. Objectives - 2005:

1. Develop adult lamprey collection, tagging and release operations at McNary and Ice Harbor dams.
2. Develop HD PIT detector systems to monitor key locations in fishways at McNary Dam and four lower Snake River dams.
3. Monitor movements and behavior of adult lamprey migrants at McNary Dam and four lower Snake River dams.

C. Methods

C. 1 Develop adult lamprey collection, tagging and release operations at McNary and Ice Harbor dams.

Adult lamprey have been successfully collected from fishways at Bonneville, John Day and Priest Rapids dams. Collection methods have involved both trapping and dipnet collection from areas where lamprey accumulate. We propose to install traps similar to those used at Bonneville Dam to collect fish for passage evaluations at McNary Dam. Lamprey typically pass McNary Dam for about a 3-month period between mid-July until mid-October (Figure 1). This is also the period of warmest water temperatures and a time when relatively few salmon are passing the dam. We will work with project biologists to determine the best location for collecting lamprey. Optimal locations for trapping would be in the south ladder near the main fishway entrances. Underwater video will be employed to survey likely locations to collect fish. Trapping will occur only at night to eliminate potential impacts on salmonid passage, and traps will be removed from the fishway during the day.

Each morning, collected fish will be anaesthetized, counted, weighed and measured. Fish will then receive a HD PIT tag (23 x 4 mm), surgically inserted into the body cavity. Following recovery, tagged fish will be released to the tailrace of McNary Dam. We propose to tag and release adult lamprey throughout the period from July to October. We propose to tag a minimum of 200 fish with HD PITs. A subsample of about 40 (20% of sample) individuals will also be surgically outfitted with radio transmitters and released with the fish bearing only an HD PIT. These radio-tagged fish will allow verification of the detection efficiency of the HD PIT detectors and will provide information on the fates of fish that do not re-appear at the project. Telemetry monitoring will be conducted using existing telemetry equipment at the dam. Depending on the availability of fish at McNary Dam, we also propose that a sample of no more than 100 PIT-tagged lamprey be transported and released in the tailrace of Ice Harbor Dam to allow evaluation of passage success at this project and in the Snake River. We will also attempt to collect individuals at Ice Harbor Dam for tagging (from juvenile bypass or dipnetted from fishway areas), as time allows.

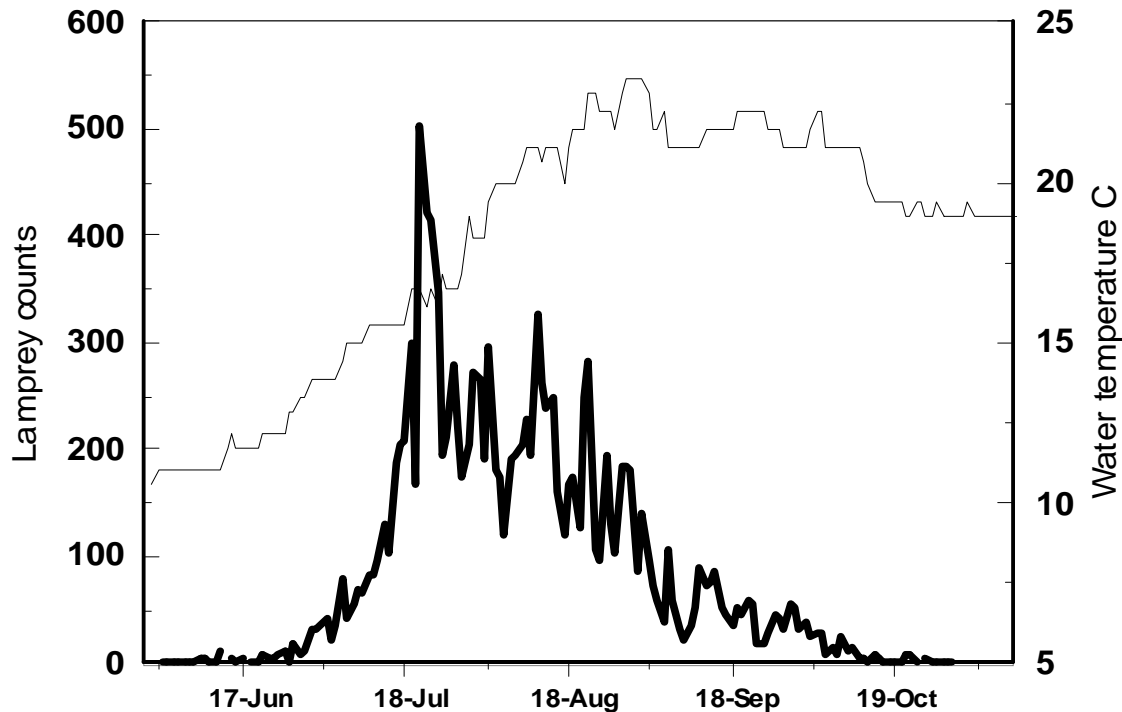


Figure 1. Lamprey counted and water temperatures at McNary Dam, 2003.

C. 2 Develop HD PIT detector systems to monitor key locations in fishways at the dams.

Half-duplex detectors alternately transmit and rest at ten cycles per second. It is during the resting stage that detectors can receive and decode a signal from a HD transponder. HD systems have larger read ranges than currently possible with full duplex (FDX) systems, on the order of 5 to 10 ft. However, the smallest HD tags currently available are about twice the size (23 x 4 mm) of the standard FDX tags (12 x 2 mm). Components of an HD systems include a reader, data storage device (PDA or pocket computer), antenna tuner, and antenna. Antennas consist of a loop of low gauge electrical wire that can surround a passage area or portal. A multiplexor is available that allows monitoring up to four antennas per reader, with each added antenna being scanned sequentially. So, with four antennas in use, each would be scanned 2.5 times per second

We propose to install HD PIT detection sites at each of the three main entrances at McNary Dam (WFE, NFE, SFE), within fishways near the base of ladders (transition pools) and at fishway exits. Multiple antennas will be used per reader to determine directionality. HD antennas will be positioned to overlap, or be bracketed by, existing radiotelemetry antennas (Figure 3). Depending on the winter de-watering schedule, some antenna placements at fishway entrances may require SCUBA divers to help with installation. Similar placement of HD PIT detectors can be made at Ice Harbor dam to monitor tagged lamprey collected and transported from McNary Dam.

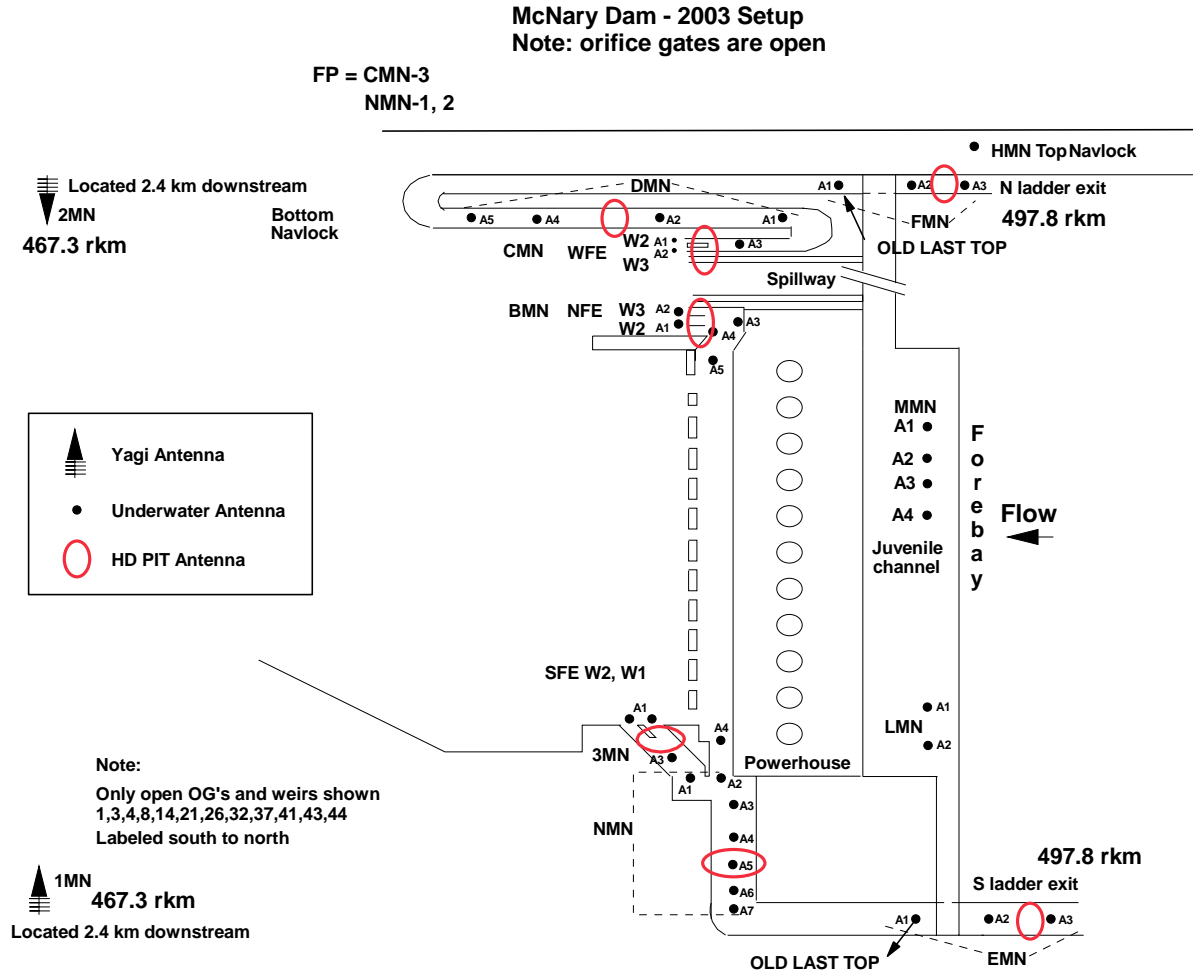


Figure 2. Schematic of proposed radio and half-duplex PIT antenna placement for monitoring passage of adult lamprey at McNary Dam.

C. 3 Monitor movements and behavior of adult lamprey migrants at McNary and four lower Snake River dams.

HD PIT and radiotelemetry receiver sites will be downloaded at regular intervals by transferring data to a portable computer. Internal times on all receivers and readers will be synchronized to assure comparability between data collected with the two systems and between different sites. Data will be loaded to a database operated on an SQL server. PIT and telemetry data will be processed separately and the results will be compared. Telemetry records will be screened to remove obvious error (noise) records and detections that occur before fish were released. Screened records will be processed to identify specific fish behaviors, such as approaches, entrances, and exits to the fishways, using an automated computer program. Coded records will then be inspected for accuracy and imported to spreadsheets for analyses. We will summarize numbers and proportions of fish that successfully navigate segments of the fishways at McNary Dam; those that return to the dam and approach an entrance, enter a fishway, reach and pass through transition pools,

ascend the ladders, traverse flow control sections at tops of ladders, and exit to the forebay. Entrance efficiency will be defined as the number of fish that successfully enter divided by the number that approach a given entrance (X 100).

Data from HD PIT detectors will be compiled to a database so that similar passage summaries can be made. Specifically, we will evaluate the proportion of fish that approach and then successfully enter each fishway entrance, reach and ascend ladders, and exit to the forebay at each dam.

D. Facilities and Equipment

HD PIT tag detection equipment will be purchased and assembled prior to the winter dewatering schedule for McNary and Ice Harbor dams. Installation of equipment will occur during the period when fishways are dewatered. Radiotelemetry equipment used during 2005 will be similar to that used in 2004. No additional radio receivers will need to be acquired. The required number of PIT tags and transmitters will be ordered by late 2004 after consultation with CORPS personnel to insure delivery for the 2005 field season. Computers and vehicles will be supplied by the researchers as needed on a rental basis. Installation of new antennas and repairs to existing antennas will be made during the winter maintenance periods at dams, and will be completed prior to commencement of tagging in summer of 2005.

E. Impacts of study on USACE projects and other activities

Division or district USACE personnel will be needed to provide technical review of research proposed for 2004.

Assistance from project personnel will be required as follows:

1. Provide electrical power supply at McNary and Ice Harbor dams for electronics gear that will be used in the fishways and tailrace areas during 2005.
2. Access to fishways will be needed to install, repair and test electronic and trapping equipment. Some dive work may be needed to install antennas at fishway entrances.
3. Provide access to tailrace and fishways for regular downloading of radio receivers year around.
4. Provide access to fishways to trap adult lamprey at McNary Dam.
5. Space to process, hold, and tag adult lamprey will be needed in close proximity to ladder trapping site. In addition, we will need a water supply at this site to hold trapped lamprey prior to tagging.

F. Biological Effects:

Fish for studies outlined here would be collected and tagged at McNary Dam during 2005. Tagging will take place during the work week. Fish will be trapped from the fishway, selected for tagging, anesthetized, fitted with PIT tags and/or transmitters, and released approximately 1 km downstream from the dam or back to the fishway after a suitable recovery period. Indirect effects on lamprey from tagging are a delay for fish to re-ascend the 1 km of river and reenter a fishway at McNary Dam. In 2003, over 13,000 lamprey were counted passing the McNary Dam. The 300 fish proposed for tagging could be 2-3% of the run in 2005.

We will coordinate with other researchers conducting radio telemetry studies with lamprey and salmon to avoid duplicate use of frequencies and codes in transmitters in the system.

G. Reporting Schedule

Information and analyses from this study will be provided regularly to managers via reports and verbal presentations.

Progress reports or presentations of results will be provided at up to three meetings, as requested by the POC and oral presentations summarizing 2005 field effort and providing results from preliminary analyses will be provided at the Annual AFEP Review. Additional information, updates, summaries, etc., will be provided for other managers as needed and when time allows.

The draft report of 2005 monitoring results will be provided by 1 January 2007.

A final report should be completed approximately 30 days following receipt of USACE review comments on the draft report. Information that is appropriate will be published in peer-reviewed journals.

H. Key Personnel

Project planning, administration, final reporting:

Principle investigators, C. A. Peery, ICFWRU, M. L. Moser, NOAA Fisheries

Work plan preparation, protocols, computer programs, permits:

C. Peery, B. Daigle, M. Jepson ICFWRU, M. Moser NOAA Fisheries

Equipment specifications and purchase:

K. Tolotti, B. Daigle, ICFWRU, J. Simonson, M. Moser, NOAA Fisheries

Tagging of fish

C. Peery, UI Graduate Student, ICFWRU, M. Moser, NOAA Fisheries

Installation and maintenance of receivers equipment at dams and downloading data

K. Tolotti, B. Daigle, UI Graduate Student, ICFWRU, J. Simonson, M. Moser NOAA Fisheries.

Mobile tracking and gathering of recapture information:

UI Graduate Student ICFWRU

Data coding/processing:

M. Jepson, UI Graduate Student, ICFWRU, D. Ogden, NOAA Fisheries

Database management

B. Burke, K. Frick, NOAA Fisheries

Analysis of data and preparation of report segments and presentations

UI Graduate Student, C. Peery, ICFWRU, M. Moser, NOAA Fisheries

I. References

- Close, D. A., M. Fitzpatrick, and H. Li. 2002. The ecological and cultural importance of a species at risk of extinction, Pacific Lamprey. *Fisheries* 27:19-25.
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- Jackson, A. D., and six coauthors. 1996. Pacific lamprey research and restoration annual report 1996. Bonneville Power Administration, Portland, Oregon.
- Moser, M. L., P. A. Ocker, L. C. Stuehrenberg, and T. C. Bjornn. 2002. Passage efficiency of adult Pacific lamprey at hydropower dams on the lower Columbia River, USA. *Transactions of the American Fisheries Society* 131: 956-965.